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EXAMINER	
RUGGLES, JOHN S	
ART UNIT	**PAPER NUMBER**
1756	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Applicati n N .	Applicant(s)
	10/689,547	CROCKER ET AL.
	Examin r	Art Unit
	John Ruggles	1756

-- The MAILING DATE f this c mmunicati n app ars on the c ver sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 27 February 2006.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-97 is/are pending in the application.

4a) Of the above claim(s) 4,5,58,74-78 and 83-97 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-3,6-57,59-73 and 79-82 is/are rejected.

7)☒ Claim(s) 81 and 82 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 21 October 2003 is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 7,10/04,10/05,3/06.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Applicants' election with traverse of Group I (claims 1-73 and 79-82) as further limited to specie (A) (2) drawn to only methods of repairing or making phase shift masks (PSMs) for radiation lithography, in the reply filed on 2/27/06, is acknowledged. This elected specie being asserted by Applicants to read on claims 1-4, 6-73, and 79-82. The traversal is on the ground(s) that Group III (claim 83) has been requested by Applicants to be examined along with Group I, since the additional search effort is asserted to not be large.

However, this is not found persuasive for at least the following reasons. Applicants have not disputed the previously indicated different classifications for Group III in class 427 and the elected specie of Group I in class 430. The different inventions of Groups I and III also have different functions. The first processes of the elected specie in Group I involve repairing or making PSMs by deposition and optional etching (without prior inspecting of an object), while the second process of Group III requires inspection of an object before repairing by selective coating (but without making or repairing PSMs involving subsequent etching). Also, the different inventions of Groups I and III are both unrelated and distinct under MPEP § 806.04 and MPEP § 808.01 (as previously pointed out and not specifically refuted by Applicants). These inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification and also because of their recognized divergent subject matter, so restriction for examination purposes as indicated is proper.

Furthermore, MPEP § 803 states, in part, "a serious burden on the examiner may be *prima facie* shown if the examiner shows by appropriate explanation of separate classification, or

separate status in the art, or a different field of search as defined in MPEP § 808.02". The distinct invention of Group III and the elected specie of Group I have been previously shown to be separately classified, so Applicants' request to have Group III examined along with the elected specie of Group I would place a serious additional burden on the Examiner. Therefore, the restriction requirement is still deemed proper and is now made FINAL.

With respect to Applicants' assertion that the elected specie of Group I drawn to only methods of repairing or making PSMs for radiation lithography reads on claims 1-4, 6-73, and 79-82, this assertion is not agreed to by the Examiner for at least the following reasons. Claims 4 and 58 each specifically recite non-elected species (3)-(6), but do not include the elected specie (2) and so these claims are withdrawn as non-elected.

Claims 4-5, 58, 74-78, and 83-97 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to nonelected inventions. Therefore, only claims 1-3, 6-57, 59-73, and 79-82, as they are further limited by the elected specie (2) drawn to only methods of repairing or making phase shift masks (PSMs) for radiation lithography, remain under consideration.

Information Disclosure Statement

All four information disclosure statements (IDS's) submitted on 7/21/04, 10/13/04, 10/25/05, and 3/16/06, have been considered by the Examiner, with the following corrections: on the 10/25/05 IDS sheet 1 of 3, the two US application serial numbers cited as C17 and C18 at the bottom of the US Patent Documents section have been updated to US 2005/0255237 published 11/17/05 to Zhang et al. and US 2005/0235869 published 10/27/05 to Cruchon-Dupeyrat et al., respectively. It is noted that the Hsieh US patent 5,441,386 (cited as C3 on the

10/25/05 IDS, which has been considered) does not correspond with the description attributed to Balz et al., instead of Hsieh, found at instant page 4 in the second full paragraph.

However, the listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609.04(a) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless such references have been either included in a proper IDS, as referenced above, or cited by the examiner on form PTO-892, they have not been considered.

Drawings

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because (i) reference characters "1" in Figure 3A and "4" in Figure 3B have both been used to designate the photomask in each of these figures; also (ii) reference characters "4" in Figure 3A and "5" in Figure 3B have both been used to designate the right probe in each of these figures.

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because (iii) reference character "4" has been used to designate both the right probe in Figure 3A and the photomask in Figure 3B.

The drawings are also objected to at least because: (iv) in Figure 1, the pattern in the legend labeled as "Clear defect filled" does not correspond with the pattern used to indicate filled areas of clear defects 1, 2, and 3 in the right-hand side illustration; (v) "Figure 3" is mentioned in the specification at page 15 line 24 but is not found in the drawings; (vi) Figure 19 is too dark and not clear enough to distinguish lines described as having been formed in the feature; (vii) Figure 21 is also too dark to distinguish any detail or edges for the described initial additive

repair; and (viii) Applicants are further expected to correct any other errors not specifically listed above in either the drawings or their corresponding descriptions in the specification.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

The abstract of the disclosure is objected to at least because: (1) in line 3, "substractive" should be corrected to --~~substractive~~ <u>subtractive</u>--; (2) in line 4, "Height of the nanostructure filling the hole" should be changed to --Height<u>s</u> of the nanostructure<u>s</u> filling the hole<u>s</u>--; (3) in line 5, "nanostructure" should be changed to --nanostructure<u>s</u>--, both in order to better correspond with the plural form of these terms previously found in lines 3-4; and (4) the abstract does not specifically include the elected claimed specie drawn to methods of repairing or making

phase shifting masks (PSMs) for radiation lithography, which should be added (e.g., by amending the phrase in line 6 “as well as more advanced masks including” to --as well as phase shifting masks (PSMs) and more advanced masks including--, etc.). Correction is required. See MPEP § 608.01(b).

35 U.S.C. 112, first paragraph, requires the specification to be written in "full, clear, concise, and exact terms." The specification is replete with terms, which are not clear, concise and exact. The specification should be revised carefully in order to comply with 35 U.S.C. 112, first paragraph. Examples of some unclear, inexact or verbose terms used in the specification are: (1) on page 1 in the introduction section, first paragraph line 2, “the repair” should be changed to --to the repair--; (2) on page 3 in the third to the last line at the bottom of the page, “optical phase correction (OPC)” should be corrected to --optical [[phase]] proximity correction (OPC)--, as abbreviation “OPC” is normally used in the mask art; and (3) at page 4 in the second full paragraph line 9, “Balz et al., U.S. Patent No. 5,441,386” should be corrected to --~~Balz et al.~~ Hsieh, U.S. Patent No. 5,441,386--, in order to correspond with the inventor name for this patent given on the 3rd IDS filed 10/25/05 as cite number “C3”. Note that due to the number of errors, those listed here are merely *examples* of the corrections needed and do *not* represent an exhaustive list thereof.

Appropriate correction is required. An amendment filed making all appropriate corrections must be accompanied by a statement that the amendment contains no new matter and also by a brief description specifically pointing out which portion of the original specification provides support for each of these corrections.

Claim Objections

Claims 81-82 are objected to because of the following informalities: in claim 81, "an scanning probe microscope" should be corrected to --a[[n]] scanning probe microscope--. Claim 82 depends on claim 81. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 37-39 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In each of claims 37-39, the phrase "the subtracting of material" lacks proper antecedent basis. However, for the purpose of this Office action and in order to advance the prosecution of this application, each of claims 37-39 have been interpreted as depending on claim 36 (which provides the needed antecedent basis for the above phrase), instead of depending on claim 1.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-2, 6-14, 17-23, 25-26, 30-33, 36-38, 47, 50-51, 54-57, 59-60, 66-73, 79, and 81 are rejected under 35 U.S.C. 102(b) as being anticipated by Cohen (US 5,865,978).

Cohen teaches nanoscale production or modification of near field masks (title), including repairing or fixing mask defects (c12/L33-46), by using an STM (scanning tunneling microscope, which is among the many types of scanning probe microscopes (SPMs) that include atomic force microscopes (AFMs), c2/L34-41, both of which have been known for manipulating individual atoms to create nanoscale structures, c3/L9-19) as an "electrochemical paintbrush" for transfer coating of copper (Cu) from a massive Cu supply to the STM electrode (shown in Figure 6A as platinum (Pt) 131 with a paraffin insulator film 132, leaving only the Pt tip uncovered, c9/L60 to c10/L31), then to an ITO surface without degrading the STM tip (abstract). An STM deposits a pattern of Cu or other suitable opaque material that is electroplateable (e.g., gold (Au), silver (Ag), tin (Sn), zinc (Zn), nickel (Ni), chromium (Cr), etc.) on a transparent ITO electrode, which is then used as a photolithographic mask. With reference to Figure 9B, a near field mask 800 is directly placed against a photosensitive substrate (e.g., a semiconductor chip 804 or wafer, etc.) coated with a light sensitive resist 802, and exposed to a light source. Preferably, the opaque mask pattern is placed in touching contact with the resist coating. This STM method has high resolution at the nanoscale for making or repairing masks having high resolution patterns for sub-wavelength exposure of a resist (e.g., nanolithography, etc.), while retaining the speed and production volume of conventional photolithography (c15/L17-61). As an example, Figures 8A and 8B show STM scans before and after Cu deposition, to fill in between the ridges shown in Figure 8A. In this example, the area filled in with metal varies from about 5nm to 10nm wide at the base to about 20nm to 30nm wide at the top, about 130nm long, and over 50nm high (c13/L34-47, instant claims 1-2, 7-14, 18-21, 26, 30-32, 47, 50-51, 54, 56-57, 59, 66-68, 70-72, 79, and 81). However, it is specifically disclosed to be important that this method is not confined

to use in the nanoscale range and can alternatively be used to deposit, mill, or remove material in larger dimensional amounts (instant claims 22-23, 36-38, 60, and 69), for depositing other electrochemically active material besides opaque metal (such as optically transparent material, e.g., indium tin oxide (ITO), instant claims 17, 25, 33, 55, and 73) that has desirable optical properties, or for other uses in either inorganic or organic chemistry (c13/L52-65, c14/L4-28, instant claim 6).

Claims 1-3, 6-14, 17-18, 25-27, 30-34, 36-38, 47, 50-51, 54-57, 79, and 81 are rejected under 35 U.S.C. 102(b) as being anticipated by Yedur et al. (US 6,197,455).

Yedur et al. teach a method of repairing a lithographic photomask or mask (specifically contemplated to overcome previous drawbacks of ion beam or laser beam repair techniques for masks that typically yield either unacceptable results or introduce undesirable phase or transmission defects in the final mask, c2/L16-24, such as a phase shifting mask, PSM) intended for the semiconductor industry (c1/L5-19) by involving use of a scanning tunneling microscope (STM) to either remove material from excess defects or deposit material in voids or deficiency defects (abstract). STM imaging or patterning of a resist improves accuracy of the mask repair, allowing defects having a size of only 10 Å (1 nm, 0.001 microns) <u>or greater</u> to be corrected (c2/L59-62, emphasis added), which for square shaped defects would be equivalent to each single defect on the mask or PSM having an area = 0.000001 square microns or greater. Deposition to repair defects includes STM tip induced reaction with surrounding gases to deposit suitable material (c6/L52-67), such as carbon (C), chrome (Cr), amorphous silicon (Si), or other compatible material, including that resulting from the reaction of C atoms in the surrounding gases with a tungsten (W) STM tip (c7/L1-16, reading on chemical vapor deposition (CVD) to

repair a defect on a mask, such as a PSM, instant claims 1-3, 6-14, 17-18, 25-27, 30-32, 36-38, 47, 50-51, 54, 56-57, 79, and 81). This method is not limited to only the materials listed above, but may be used to repair any number of mask materials (c7/L34-37, instant claims 33-34, 55).

Claims 1-2, 6-8, 14, 18-23, 26, 29-34, 36-38, 51, 54, 56-57, 59-60, 66-73, 79, and 81 are rejected under 35 U.S.C. 102(b) as being anticipated by Bard et al. (US 4,968,390).

Bard et al. teach high resolution deposition and etching in polymer films (title) utilizing a scanning electrochemical microscope (SECM) as a modified version of an STM for etching and electrochemically depositing various conducting substances on the surface of a conductive object that includes placing the SECM tip in contact with the conductive object (abstract). This allows deposition of extremely fine patterns of metals, semiconductors, or polymers in polymer films and etching of a conducting substrate with very high resolution (c1/L15-20). Figures 2(a)-(d), 4(a)-(b), and 5-6 show copper (Cu) lines about 1,000nm in width, silver (Ag) lines ≤ about 500nm in width, Cu deposits < about 500nm in diameter, and an etched Cu line < about 1,000nm in width (c4-7). Applications include deposition of semiconductors or electrically conductive polymers, controlled polymerization or crosslinking of a polymer film, deposition of several metals and/or polymers in the same film, insulator or metal oxide deposition (e.g., Al_2O_3, SnO_2, Fe_2O_3, etc.), and deposition of structures composed of two or more different materials (c6/L61-c7/L21). A specifically described embodiment includes repairing or producing of masks with high resolution features (e.g., for x-ray or electron beam lithography, etc.) by deposition (of e.g., Au, etc.) lines that are typically on the order of 500nm-1,000nm in depth or thickness (c2/L56-59, c6/L53-55, c7/L22-31). This technique provides constant tip/substrate electrode distance for uniform films and results in more uniform structures (c3/L15-18). Figure 3 shows an example

for using this method to produce or repair a mask pattern having a conductive pattern (of e.g., gold (Au), chromium (Cr), etc.) by deposition on a transparent substrate using a high resolution SECM or STM tip (see claim 5 and c7/L53-c8/L5, instant claims 1-2, 6-8, 14, 18-23, 26, 29-34, 36-38, 51, 54, 56-57, 59-60, 66-73, 79, and 81).

Claims 40-42, 46-49, 51-53, 57, 59-63, 66, 68-71, and 73 are rejected under 35 U.S.C. 102(b) as being anticipated by Lewis et al. (Fountain Pen Nanochemistry: Atomic Force Control of Chrome Etching, Applied Physics Letters, Vol. 75, No. 17, 1999).

Lewis et al. teach a process of repairing a mask by delivering liquid or gas through a cantilevered hollow micropipette attached to an atomic force microscope (AFM) tip or probe head, allowing nanometric spatial control of specifically localized chrome etching to be demonstrated without detectable effects on the underlying glass substrate of the mask (abstract). For the micropipette, a quartz nanopipette can have an outer diameter at the tip of 10nm and a hole in the middle that can be as small as 3nm (p2689/left col.). A reflective metal layer on the backside is used to detect bending movement of the AFM cantilever (Figure 1, p2689/right c.). The width of etched lines includes specific examples at 100nm and 1,150nm, with the depth exemplified by 120nm and 200nm, respectively (p2691/left c.). Contemplated variations include the use of intermittent contact-mode AFM delivery similar to that achieved by an ink jet printer, controlled distribution or confinement of liquid between the pipette and the substrate treated (e.g., to repair a patterned mask, etc.) by altering the geometry or the surface of the hollow pipette tip to be either hydrophobic or hydrophilic, or equipping the pipette to apply an electrical voltage or illumination on the surface treated to further improve resolution of the pattern formed or repaired (e.g., on the mask, etc.). This technology has wide implications both for the use of

this methodology in controlled nanochemistry with liquids or reactive gases (p2691/right c., instant claims 40-42, 46-49, 51-53, 57, 59-63, 66, 68-71, and 73).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-3, 6-23, 25-27, 29-42, 44-57, 59-73, and 79-82 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Cohen (US 5,865,978), Yedur et al. (US 6,197,455), or Bard et al. (US 4,968,390) in view of either Lewis et al. (Fountain Pen Nanochemistry: Atomic Force Control of Chrome Etching, Applied Physics Letters, Vol. 75, No. 17, 1999) or Miller (US 6,270,946).

While teaching the use of a SPM probe tip, such as a STM probe tip or a SECM probe tip, for patterning processes to produce or repair a mask (e.g., a PSM, etc.), none of Cohen, Yedur et al., nor Bard et al. specifically teach the use of an AFM tip or a hollow tip for such patterning processes.

The teachings of Lewis et al. are discussed above.

Miller teaches a process of patterning and/or building up layered nanoscale features on a substrate by selectively applying first and second materials with a nanoscale delivery device. A first difunctional molecule is applied and reacted with a surface of the substrate and a second difunctional molecule is applied and reacted with previously unreacted functional groups from the first difunctional molecule to form a patterned layer on the surface of the substrate (title,

abstract). The difunctional molecule may be any that is known to those skilled in the art, such as a difunctional monomer, oligomer, or polymer. The number or repeating units in the backbone of the molecule can range from one to thousands (1 to 1,000s), depending on the final application and intended use (c2/L39-48). Any known substrate material can be used, particularly materials such as glass, metal (Au), silicon (Si), polymers, or germanium (Ge) are given as examples of suitable substrate materials (c2/L59-67, which would make such a process compatible with patterning or repairing a finely patterned mask having a metal pattern on a glass substrate). Any device known to those skilled in the art may serve as the nanoscale delivery device. Figure 2 shows the device 40, in general, comprising a probe 50 having a microfluidic device 60 attached thereto. One type of probe used is a proximal probe from an atomic force microscope (AFM). The microfluidic device forces or encourages the flow of the molecule to be applied to the surface of a substrate or another molecule. The probe may be chemically treated to induce transfer. Alternatively or in addition to the chemical treatment, a carbon nanotube may be incorporated into the probe tip. These nanotubes function similarly to that of a (hollow) fountain pen, making it possible to transfer the difunctional molecule to the substrate or to direct placement of the difunctional molecule with respect to a previously reacted difunctional molecule. The nanoscale delivery device allows formation of an ultra small pattern for further processing into such devices as semiconductors or electronic devices in a cost effective, well controlled manner (c3/L31-53). Reaction of the first and second difunctional molecules at functional groups can be enhanced by exposure to a radiation source, such as a scanning electron beam, x-rays, ultraviolet (UV) or visible light, or a thermal energy source (c2/L54-65). The radiation energy source can be extended from a nanoscale delivery device, as previously

described (c3/L33-34). AFM probes have been previously known to transfer a very small amount of chemical material onto a surface to form a very small feature (tens of nm in dimension, c1/L36-40).

It would have been obvious to one of ordinary skill in the art at the time of the invention in the patterning processes to produce or repair a mask (e.g., a PSM, etc.) with extremely fine control over coating and/or etching steps by using a SPM probe tip, such as a STM probe tip or a SECM probe tip (taught by either Cohen, Yedur et al., or Bard et al.), to use an alternative and/or an additional SPM probe tip, such as a hollow tip AFM probe (as taught by either Lewis et al. or Miller), in order to extend the substrate materials treated by extremely finely controlled coating and/or etching to electrically non-conductive substrates as well as conductive substrates, including multilayer structures of diverse materials (e.g., to repair a mask such as a PSM having a conductive metal pattern on a non-conductive substrate, etc., instant claims 1-3, 6-23, 25-27, 29-42, 44-57, 59-73, and 79-82), because an AFM probe tip can be used with a non-conductive substrate.

Claims 1-3, 6-27, 29-57, 59-73, and 79-82 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Cohen (US 5,865,978), Yedur et al. (US 6,197,455), or Bard et al. (US 4,968,390) in view of either Lewis et al. (Fountain Pen Nanochemistry: Atomic Force Control of Chrome Etching, Applied Physics Letters, Vol. 75, No. 17, 1999) or Miller (US 6,270,946) and further in view of Park et al. (US 5,871,869).

While teaching other aspects of the instant claims, none of Cohen, Yedur et al., Bard et al., Lewis et al., nor Miller specifically teach using a sol-gel coating material (instant claims 24, 43, 50, 64, and 73) for patterning or repairing a PSM.

Park et al. teach a method of manufacturing a PSM that includes patterning a PS layer (title, abstract). This PSM is usable for forming fine patterns in a semiconductor device (c1/L5-11). Figure 2 shows an example of a PSM having a PS layer of a metal oxide (e.g., TiO_2, ZrO_2, CrO_2, ZnO_2, etc.) coated by a sol-gel method to yield a refractive index of about 1.6 to 2.3 on a transparent substrate (e.g., of soda lime glass, quartz, etc.). The thickness of the PS layer (e.g., about 140nm to 310nm, etc.) formed from the sol-gel is determined from equation 1 based on the incident exposure wavelength (e.g., 365nm, etc.) and the refractive index of the PS layer, in order to shift the phase of the incident light by 180° (c3/L15-39, c4/L6-8).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention in the patterning processes to produce or repair a mask (e.g., a PSM, etc.) with extremely fine control over coating and/or etching steps by using a SPM probe tip, such as a STM probe tip or a SECM probe tip (taught by either Cohen, Yedur et al., or Bard et al.) and/or a hollow tip AFM probe (taught by either Lewis et al. or Miller) that includes depositing a desired thickness of transparent PS sol-gel coating material on the PSM (as taught by Park et al.), because this would be expected to provide a method for producing or repairing transparent PS material on a PSM by extremely finely controlled coating on either electrically conductive or non-conductive substrates, including multilayer structures of diverse materials (e.g., to repair a mask such as a PSM having a conductive metal pattern on a non-conductive substrate, etc., instant claims 1-3, 6-27, 29-57, 59-73, and 79-82).

Claims 1-3, 6-14, 17-23, 25-34, 36-38, 47, 50-51, 54-57, 59-60, 66-73, 79, and 81 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Cohen (US 5,865,978), Yedur et al. (US 6,197,455), or Bard et al. (US 4,968,390) in view of Hattori et al. (US 2002/0086223).

While teaching other aspects of the instant claims for patterning processes to produce or repair a mask (e.g., a PSM, etc.) with extremely fine control over coating and/or etching steps by using a SPM probe tip, none of Cohen, Yedur et al., nor Bard et al. specifically teach the deposition of material including nanoparticles (instant claim 28) for these patterning processes.

However, Hattori et al. teach that it has been known to pattern a PS material on a PSM by either coating a transparent film (e.g., glass, etc.) on a mask substrate or just starting with such a transparent material (e.g., glass, etc.) substrate for a mask, etching through a patterned resist to form a PS pattern, then coating a film containing nanoparticles (e.g., in a binder, etc.), and patterning the film containing nanoparticles to form a shade pattern on the PSM ([0048]-[0049], as an opaque or a light blocking pattern on the PSM).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention in the patterning processes to produce or repair a mask (e.g., a PSM, etc.) with extremely fine control over coating and/or etching steps by using a SPM probe tip (as taught by either Cohen, Yedur et al., or Bard et al.) to deposit a known alternative for opaque coating material that includes nanoparticles, in order to form or repair an opaque material pattern on the mask or the PSM with a reasonable expectation of success (as taught by Hattori et al., instant claims 1-3, 6-14, 17-23, 25-34, 36-38, 47, 50-51, 54-57, 59-60, 66-73, 79, and 81).

Claims 1-3, 6-23, 25-42, 44-57, 59-73, and 79-82 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Cohen (US 5,865,978), Yedur et al. (US 6,197,455), or Bard et al. (US 4,968,390) in view of either Lewis et al. (Fountain Pen Nanochemistry: Atomic Force Control of Chrome Etching, Applied Physics Letters, Vol. 75, No. 17, 1999) or Miller (US 6,270,946) and further in view of Hattori et al. (US 2002/0086223).

While teaching other aspects of the instant claims for patterning processes to produce or repair a mask (e.g., a PSM, etc.) with extremely fine control over coating and/or etching steps by using a SPM probe tip, none of Cohen, Yedur et al., Bard et al., Lewis et al., nor Miller specifically teach the deposition of material including nanoparticles (instant claim 28) for these patterning processes.

The teachings of Hattori et al. are discussed above.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention in the patterning processes to produce or repair a mask (e.g., a PSM, etc.) with extremely fine control over coating and/or etching steps by using a SPM probe tip (as taught by either Cohen, Yedur et al., or Bard et al. and either Lewis et al. or Miller) to deposit a known alternative for opaque coating material that includes nanoparticles, in order to form or repair an opaque material pattern on the mask or the PSM with a reasonable expectation of success (as taught by Hattori et al., instant claims 1-3, 6-23, 25-42, 44-57, 59-73, and 79-82).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John Ruggles whose telephone number is 571-272-1390. The examiner can normally be reached on Monday-Thursday and alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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